Natural Resources Economics

Lectures of

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Jan., 2000.

ECONOMICS OF THE NATURAL RESOURCES

Course Contents

Part 1. Definition and Characteristic of Natural Resources :

a. Definitions :

A *natural resources* is simply a resource provided by nature, a good exiting in the universe, yet not limited solely to physical things Therefore, natural resources are the natural endowment to a country These resources, have no value until they have been discovered and an economic use has been found for them. Natural resources, then, are a function not only of their physical existence, but also depend on :-

1. Our knowledge of them,
2. The technology to use them,
3. Ability to make economic use of them.

We have discovered economics uses for only a minute fraction of resources in and on the earth and its surroundings. How much remains to be discovered ? How many new uses can be discovered ?. The answer is the human has to increase discoveries.

Of the wide array of resources around us, the one that most typically comes to mind when the term natural resource is used is *land* from which we derive our food and fiber, space over which to transport people and goods, building materials, space for homesites, for recreation and aesthetic purposes.

Other natural resources are the *water* that exists in lakes, streams, rivers, or in underground channels and reservoirs; *minerals* in their many types, locations, and varying concentrations; and self-propagating *plant and animal life*, all of which are of immense

usefulness to humankind And if plant and animal life, all of which are of immense usefulness to humankind. *Humans*, who, with their labor and other productive abilities, are probably the most important of all natural resources

a.1. Resource Supplies

Having some knowledge of the physical amounts of various resources that are present is of value only as a limit. The *physical supply* of any resource may be defined as the total quantity provided by nature. The concept of greatest relevance is the of *economic supply,* the part of the physical supply that is used for want satisfaction. We could attempt to equate this physical quantity with the economically feasible portion of the proved reserve (the amount economically available for human use), but this is a total concept - the sum of both the amount actually used and the amount unused. If we limit ourselves to meaning that amount of the resource actually used within some time period (annually, for instance), we have been pushed to considering the equilibrium quantity, a single point on the supply curve of that resource.

With this view of economic supply, we can more readily recognize the importance of both supply and demand on how intensively we use our natural resources, and at what rates they are being consumed in the production process. These two concepts are fundamental to understanding changes that occur in our economic reserves They make clear that expansions and contractions of the economic supplies of natural resources are caused by resource price,

changes, which are the result of changes in either or both supply and demand functions.

Natural resources in themselves have no value; they have values, and command a price, only because they are capable of producing good and services people want and are willing to pay for. The demand for a resource is thus a *demand* - it is derived from the fact that the resource cam produce something else, the demand for which gets reflected back to the resource itself. Hence, the demand for land depends on (is derived from) the intensity of our demand for the products of land - food and fiber or other valued qualities, and not just because it is "land" we must now consider how this (or any other) resource's value-creation ability is reflected by the market in such a way that its economic value productivity is correctly demonstrated when a price has been paid by someone to gain control over its use.

a.2. Resource Values :

In order finally to arrive at value of a resource (its per unit "price", "market price", "market value", selling price", "productive value", we must determined the costs and returns arising with the use of that resource and the net returns resulting from its use.

Resource productivity surely must affect the price one is willing to pay. If the best use of a tract of land could return no more than a zero net income in the future, how much would you be willing to pay for it ? Would you be willing to pay more if the net return were $ 10,000 per year ? How much more ? Or, if the net return were to be a negative amount, would you pay anything at all for that resource.

Note the emphasis on *future,* rather than past or current, returns. Something is worth money only because it can produce a net return in the future, and the higher that future net return the greater its market value. You may own a $ 50,000 herd bull, prized for the value of the offspring, and you may have "made a bundle" from him over the past few years. Now suppose that he became totally important yesterday, and that fact is known to all possible buyers; today that bull is worth only what the slaughter market says he's worth, no matter what his net value productivity has been in the past, because of this inability to produce future income.

There should be (and there is) a systematic method with which to derive answers to such questions of "worth", rather than having to rely only on outright guesses. The Marginal Value Product (*MVP*) of a resource where one more unit of a resource is worth only what it can produce, giving rise to the demand curve. That is the value of a unit of the resource per unit of time (e.g., annually), an easily understood phenomenon for anything that is used up in a one-time use or application. But what if the resource, such as with most natural resources, dose not just disappear with one use but can be used again and again, even indefinitely ? The net returns earned by that resource occur as an *annual flow* throughout its productive life, and the valuation process appears to be more complex. The theoretical basis still applicable, however, but we can simplify it here.

Suppose that you presently operate a farm and that a nearby tract of land is offered for sale. You might carefully estimate the amount by which your annual receipts would be increased by buying

the land, and the amount by which your costs also would be increased. Suppose, further, that after properly deducting all the increased costs associated with using this tract land, the annual net income to land alone is $ 20 per acre and that this will continue indefinitely.

Twenty dollars received today is worth just $ 20 because it will buy $ 20 worth of goods and services right now. But what about next year's $ 20 ? And each additional $ 20 further and further into the future ? What are all those $ 20 amounts worth right now ? We must determine what each of those $ 20 is worth now to get at one lump sum figure that says "this is what it's worth now". Pay less than this amount and you got more than you have bargained for; pay more and you will have made some unnecessary sacrifices to get the resource.

Our opportunity cost concept is useful here : Suppose that the next best alternative use of your money to pay for the land is to deposit it in a savings account in your local bank that will pay interest at 5 percent. A deposit of $ 400 at 5 percent will yield that same $ 20 per year for as long as you wish (assuming the 5 percent opportunity continues), therefore, net earnings limit its present value at $ 400 per acre. You couldn't pay more that $ 400 per acre or you would be sacrificing greater alternative earnings elsewhere.

We use a formalized expression to adjust ("discount") future sums of money back to their present values, a process referred to as he *capitalization of earnings*, which determines the *capitalized* (or *present*) *value* or future earnings. This capitalization approach may seem complex, but this is exactly what the market has done when it has determined the market price of any good.

The comparison just given said, in effect, "I have a sum of money ($400), which, if invested at 5 percent, will yield $ 20 per year". The resource valuation approach is just the opposite, saying, "This resource will earn a net return of $ 20 per year, what is it worth today ?.

We will use P as a symbol for present value, A for the amount to be received in the future (with subscripts 1,2,3, etc., to signify the year in which the amounts occur), and r as the opportunity rate used for discounting. So, we have $P + Pr = A_1$, where P is the unknown (the present value); Pr, which determines the first year's earnings on that amount; and A_1, the amount that can be withdrawn after 1 year (which includes the original amount).

We know A_1 (the $20), so we must solve for P. Factoring out the common term P from the equation we have $P\ (1 + r) = A_1$. Transposing, we have $P = (A_1 / (1 + r)$ = $20/1.05 = $19.05, the *value* today of *next year's* $20.

What about the second year's $20 ?. The present value of that is the amount that would grow to $20 if deposited today and left for 2 years. P deposited today is increase by 1.05 after 1 year, and after 2 years is increased again by 1.05, or, $P\ (1 + r)\ (1 + r) = A_2$ The formula for the second year becomes $P = A_2 / (1 + r)$ – $20 / $(1.05)^2$ = $20/1.1025 = $18.14, which says that at a 5 percent discount rate, $20 to be received 2 years hence is worth $18.14 today.

As we consider more and more years into the future, the process becomes more and more difficult to handle. For n years the equation becomes

$$P = \frac{A_1}{(1+r)} + \frac{A_2}{(1+r)^2} + \frac{A_3}{(1+r)^3} + \frac{A_4}{(1+r)^4} + \ldots + \frac{A_n}{(1+r)^n}$$

Carrying out these computations for as many years as our tract of land will last would be extremely tedious. For any resource that will last for a long, long time into the future ("in perpetuity"), the formula sums algebraically to $P = A/r$. Thus, $P = \$20/.50 = \$20/.05 = \$400$, the present value of the resource able to yield a perpetual net return of \$20 per year.[1]

a.3. Resource Conservation :

Keeping the natural resources of the society productive should have the first priority of individual and public's objectives.

The *conservation* of natural resources is accomplished by a willful reduction in the rate at which these resources are used, leading

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[1]This method works well for our perfectly certain world, but in real life we cannot be that exact. Predicting yields, prices, costs, and interest rates 10, 50, or 100 years into the future becomes highly uncertain. On the other hand, how accurate is the actual market price of a long-lived asset ? It can be correct only if a perfectly competitive market (which doesn't exist) has determined that price. The degree of inaccuracy depends on imperfections in the market.
In using the capitalization approach, the nearer to the present the greater the importance of A, and the less important is r increases. Compare the 100th-year \$20 with that of the first year, and you'll notice that estimating errors out there are quire unimportant. Twenty dollars to be received 100 years from now is worth only \$0.15 today as compared with next year's \$20 worth of \$19.05 today. The present value of a perpetual annual stream of \$20 is \$400, and the 100th-year's contribution is only \$0.15 out of that total. Thus, the further into the future a return occurs the smaller becomes its contribution to present value, and the less important are our estimating errors.

to the conclusion that conservation and saving (nonuse) are one and the same. And to this is frequently added the admonition that we must "save for future generations". Doing this leads, however, to an untenable contradiction to terms. Faithful adherence to this dictum must result in perpetual nonuse because we are unable to specify which generation in the near or far-off future may have the privilege of use.

Resource saving may be cloaked in economic sounding phrases such as "efficient use", "wise use", "use without waste", but these confuse rather than clarify the meaning of conservation.

To save resources so as to have a larger quantity available in the future is of questionable value because new discoveries (or new technology yet unavailable) may result in very large increase of usable reserves, or new alternative sources of the same service. And who can foretell with any certainty what shifts might occur in the uses to which presently known reserves might be put ?. The Northern Great Plains (especially North Dakota, Montana, and Wyoming) are endowed with many billions of tons of low sulfur coal. Coal is a natural resource supply that is becoming more valuable as other traditional sources of heat energy are being depleted. To save this coal for some vague future period would a gamble which predicts that a much better or cheaper energy source will not be discovered - one that could even make these coal deposits worthless - and thus a sheer economic waste of a (presently) valuable natural resource.

To obtain compliance with noneconomic criteria is difficult even with government action "in name of society" - a government

decision process that appears much less bound by the economic costs of its action. This feeling appears to be widespread, partly because a government's planning horizon is so much longer than for individuals or firms, and it can therefore "afford it" while individuals cannot. But this rationalization is erroneous thinking. Given whatever the values and costs to society might be, the fact that these might be hidden (for a time) doesn't mean a wrong decision wasn't made.

The conservation of natural resources is an important part of the basic economic problem of dealing with scarcity by making the proper choices, accomplished only by weighing economic alternatives. As consumers economize in their production choices, the basic requirements of efficiency in resource conservation have been met.

Economic efficiency in resource use dictates that we use our resources at the time, and at the rate, and in those uses where their contribution to consumer satisfaction is the greatest. The present value of their net returns will then be maximized. And their opportunity costs for other less profitable uses will also be maximized, thereby preventing wasteful use. We are then using no more of those resources than is necessary to produce the mix and quantities of all those products that consumers will buy (which minimizes the real costs of those goods). This efficiency achieves part of the saver's basic objective on its only supportable basis - economics.

Recognizing conservation as an economic problem directs our attention to the act of responding consciously or unconsciously, to prices and costs in the use (or nonuse) of those resources. The problem with natural resources is not simply that a fund resources is

depleted with use and that we later will regret its absence. The problem is that the value of services will be lost when the resource is gone *unless* another source of that service has been discovered in the meantime.

We have optimized natural resource conservation when we have so distributed the rates at which those resources are used that we have maximized the present value of the future stream of their net social benefits. The economic meaning of conservation takes the future into account by answering the question : What is the best rate at which to utilize any resource so as to maximize net social benefits over time ? Answering this question forces a comparison of values between different time periods, the only basis for deciding what to do with any natural resource. So what we are saying is that the question of economic efficiency encompasses the question of conservation; that *resource conservation cannot be viewed as something separable from the economic of resource use.*

When we compare the values of two different periods we find ourselves making use of the type of information discussed above in the valuation section. Because a dollar in the future is not worth the same as a dollar in hand right now, we are forced to ask : Why not ? And we get around, finally, to an admission that human nature is the cause : *We prefer good now rather than is some future period.*

Given a choice of having a dollar now versus getting that dollar a year (or more) from now, we will choose possession today rather than later. We would choose to have dollar now because we could either use it to gain whatever present satisfactions can be obtained by

buying a desired good now, or invest that dollar in an interest-earning opportunity (a savings deposit, for instance) and have it grow to some larger amount and therefore able to yield more satisfaction later. This preference for good now rater than later is called our *time preference*, or time impatience.

Individual time preferences can be (and are) widely different, ranging, at any given instant, from those who will lend (invest) money now so as to enhance their future consumption, to those who borrow against the future so as to be able to consume now in preference to waiting until later. Our time preference are thus be expressed as a *rate* at which future values are discounted back to the present.

Exchanging present and future goods is facilitated by the existence of money and financial markets; exchanges being the *reason for* the existence of those markets, rather than the other way around. The market offers an interest rate for savers, or charges borrowers, permitting us to conduct transactions that demonstrate our preferences. The borrower, by the act of borrowing, has said, "I want the goods this money can buy *now* strongly enough that I'll pay the interest premium to escape having to wait until I have the cash in hand. :Whatever the interest rate paid, the borrower has exhibited a sufficiently high time preference that made consumption now "worth more" than the value of that satisfaction later, with a difference in present and future values being equal to the amount of the interest paid.

The only difference between individuals and society in this attribute is the magnitude of the time preference and the length of time

that is relevant. One cannot easily make (and carry out) plans for, say, 100 years from now; that's too far into the future and would thus be severely discounted, encouraging earlier use and consumption rather than later. Society, however, can expect (plan for) a much longer life span, which results in a lower discount rate and a postponement of use to a more distant future.

a.4. Property rights :

Property rights are the set of valid claims to a good or resource that permits use of that good or resource and the transfer of its ownership through sale. Those rights are generally limited by law and/or social customs. For many of the nation's natural resources, property rights are withheld from private ownership. They are owned by the government "in the name of the public", an ownership referred to as *common property*. Examples of such resources are forests and grazing lands, seas and lake fisheries, a variety of offshore mineral and petroleum deposits, and the air that we breathe.

With common ownership in these resources, individuals use them at rates optimized by their own private costs and returns. We each disregard any other costs that may arise as a consequence of that use because they are external to that decision maker. Factories will pollute the commonly owned air because it is not in their private economic interests to take that cost into account. In spite of the technological devices attached to today's automobiles, we still pollute the air when we drive. We each ignore that cost because it is not in our economic interests to incur further pollution control costs for the benefit of others

Common property resources do not readily lend themselves to the valuation process inherent in the institutions of private property and the marketplace. And, because we usually are free to use these resources without regard for the costs that are external to our private cost and returns, these resources are used at more intensive rates than is economically justified from the standpoint of society as a whole.

We illustrate this problem with an example diagrammed in Figure No. (1), first is one of open, uncontrolled fishing, and the second, a method of licensing that controls the number of fishers and the fish harvest. With an open fishing arrangement, only the private costs and returns of fishing are considered by those engaged in that activity. The marginal cost curves of all fishers in this market are summed horizontally to derive the supply curve S_0 in the diagram. Given the demand for fish - the demand curve D - the optimal price of fish is P_0 and the total amount of fish harvested is the quantity Qo. As a result of open fishing, the fishery stock would be depleted over time because each will harvest at a rate that ignores the impact on the present stock of fish. This arrangement will cause the cost of fishing to increase, as the people fishing will have to make longer trips and spend more time catching a given number of fish from the dwindling stock of fish. These external costs, imposed on others, plus the private costs of fishing are termed *social costs*. The sum of the social costs of fishing is shown in the supply curve S_1. The optimal quantity of fish harvested, taking all costs into account, is the quantity q_1 at price P_1, rater than the quantity Q_0 at price P_0. This over harvesting problem is similar to many other common property resource problems wherever

external costs are not included in the individual's decision-making process.

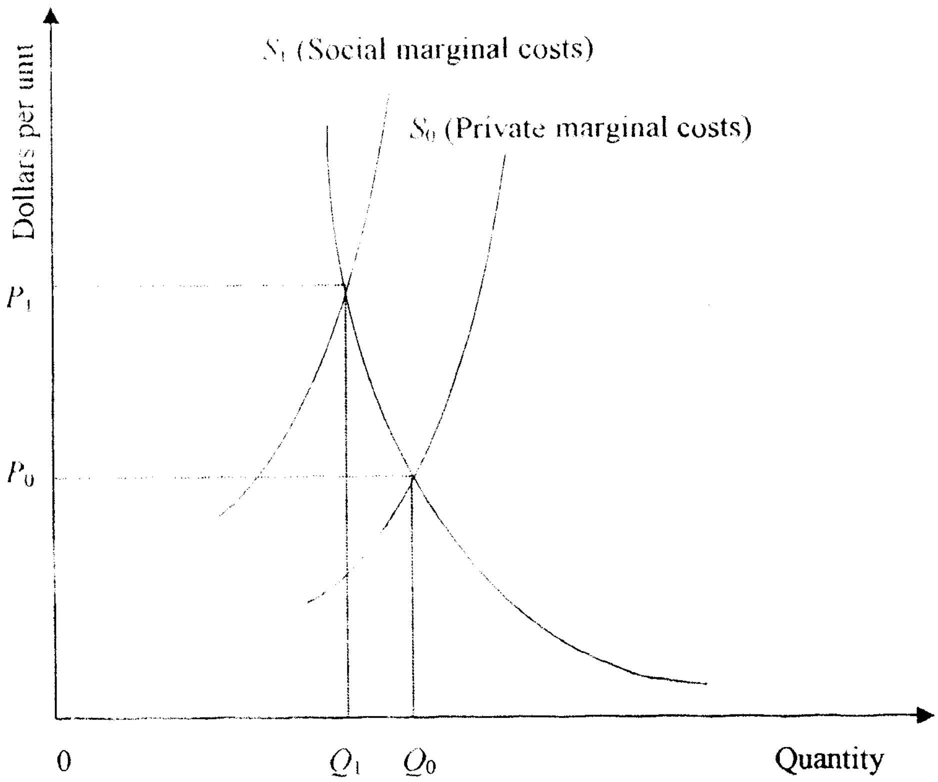

Figure No. (1) : Equilibrium in common property usage.

External costs of fishing are internalized for all who want to fish by assigning specific property rights to particular individuals. Licensing and setting individual catch limits, thereby preventing the stock depletion that would occur under open fishing. Adding the costs of property rights to all individuals' fishing decisions increases their marginal costs and causes them to reduce their fishing activities and fish harvesting rate to the more optimal Q_1, the rate are which the stock of fish can be maintained.

Even, between nations, there is rights to use natural resources. For fishing, for instance, there is right to fish is each country's regional territory. Also, through agreements and license fishing is over controlled. Another example, is the rights to allocates the Nile water among countries in Nile area. This eight countries had agreed to share water together according to annual rates. Also, between Egypt and Suddan we distribute water stock in known proportion such that Egypt can gain the share of 52.5 million qubic meters.

Another important example which show the impotence of property rights is the use of underground water for irrigation in newely reclaimed area in zones in Saini, Behaira, Sharkeya, Ismaliila, ... etc. The stock is of fixed supply (S_0) in Figure No. (2) which imply that the value. Per m^2 is determined by demand. Also, excessive withdrawal will lead to depleting the wells and hence maximizes the private benefits at the expense of social benefits. This type of conflicts should be overcommed to satisfy the needs with minimum losses now and in the future.

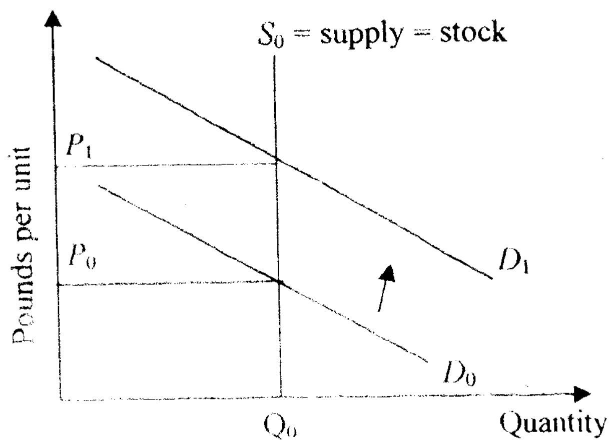

Figure No. (2) : Fixed supply price determination

Social values should not contradict the private gains and visa-versa For long, this trade - offs had led to mis-use (allocation) of resources in Egypt The government since 1986 is trying to relax a lot of conditions concerning the use of natural resources. The government had liberlized the land rent market and freed all other markets to reflect the real value and to assure efficient resource use.

Finally, the definition of propriety right was in need for further clarification in presence of externalities. The Nobel Laureate Ronald Coase (1960) has proposed solution between parties in known two assumptions coase. Theorem simply if the damages are measurable. Then, the solutions are conditioned to minimum cost through bargaining between affected parties.

b. Characteristics and Classification : Natural resources are characterized by :

1. Scarcity.

2. Unequal distribution.

Resources are scarce because they are naturally available in fixed supply. They are limited to geographical regions and position. The needs to use and utilize these resources are excessive and changes over-time. The economic use of these resources is there, demand determinate. That means that scarcity implies higher value for more use or demand shifts.

Natural endearment is not equally allocated between nations For instance, oil and gas are not distributed equally among nations Some other nations as USA which is major oil importer has good

quality land which mean excess supply of food The logic is that natural endowment is for all human This means that resources and their products must be exchanged to meat the needs even under the condition of unequal distribution Each society has a resource base and it is supposed that these resources are used technically and economically to produce the maximum output. Societies which use their resources behind this limit are not in good economic standing. Nobel Laureate James Tobin has summarized these idea in the following statement

"The whole purpose of economy is production of goods or services for consumption now or in the future. I think the burden of proof should always be on those who would produce less rather than more, on those who would have idle people or machines or land that could be used. It is amazing how many reasons can be found to justify such waste, fear of inflation, balance of payments deficits, unbalanced budgets, excessive natural debt loss of confidence in dollar"

The natural endowment - resource base - differs among nations small countries in Africa such as Malawi has natural land endowment more than Egypt. In Egypt almost 96 % of land resources are deserts. Food production is concentrated around 3 % of total physical land supply. The government of Egypt is trying to increase the economic land supply to 25 % of total endowment by the year 2017 This problem is also global since one-third of resources produce about 66 5 of the total supply The third world countries which has 66 % of the natural endowment are producing one-third of the total supplies - Now, at the beginning of 21st century most of surplus is allocated to

developed countries Poor countries, who has poor natural endowment or poor use are in very worse standing. Economic and Trade Forums this year indicate that developed countries are trying to maximize their net shares under the current conditions of globalization. In 20th century, the developed countries. We looking at the international aid to solve their economic problems and to restructure the economic activities to achieve economic efficiency. The era of international aid ended. The developed countries are now invited to share the markets. Most of these countries has to shift the current use of their economic resources to efficient use through :

(1) Improve the over-all production environment, train the labor force, and liberalized all markets.

(2) Restructure and develop their baby industries to share the economic advantage.

(3) Improve the technology to increase food supply, and

(4) Improve the quality of education and reduce the literacy rate.

b.1. Resource classification : Resources are classified according to certain views and criteria such as distribution, origin, exhaustibility and inexhaustibility, stock and flow .. etc.

Some are fixed in quantity, and using them depletes the amounts remaining. We call these *fund* (or *stock*) *resources* to reflect the fact that their quantities are fixed in their natural state. Many of our natural resources are of this type : coal, oil, natural gas, sand and stone, iron ore and other minerals, and similar natural deposits that are

nonrenewable resources whose use forever reduces their remaining quantities.

Other natural resources such as sunlight, wind, rain, tides and flowing water are called *flow resources.* Their present use does not prevent possible future use because the available quantity is constantly being replenished. If, in using the wind's power heat energy from the sun, or the flow of water in a stream does not disturb their continued flow, the amounts available for other uses are left undiminished.

A simple fund or flow classification does not adequately serve to describe all natural resources, however. Many other important resources exhibit some characteristics of both these groupings. Growing, maturing plants (the flow) may be harvested without damaging the productivity of the parent stock (the fund). The product flow can be maintained indefinitely, increased or decreased, depending on the harvesting rate and the manner in which both the fund and flow are managed. This special characteristic has led some authorities to identify these resources as either a subcategory of fund and flow resources or separately as *biological resources.*

Forest cutting can be so intensive in one period of time the future yields are reduced, even eliminated entirely. Rangeland can be overgrazed to the extent that grass regrowth and production declines later years. Ranchers may sell off brood stock, in addition to young stock, and find total output reduced until the breeding herd is again restored. Fish and wildlife harvesting may be carried on at a rate which also causes a reduction in the fund part of those resources, from

which the flow is derived, even to the point of extinction, as in the case of the dodo bird, the California grizzly bear, or the carrier pigeon.

Even the soil itself, although viewed most frequently as a fund resource, also has some of the characteristics of a flow resource. Management practices may have the deliberate objective of reducing, maintaining, or improving the level of plant nutrients held in the soil, depending on whether current practices use those nutrients at a greater, equal, or lesser rate than their inflow to the soil. Much like a savings account in the bank, the present balance of those nutrients is the result of both addition to and subtractions from that account, as well as any original amount.

The importance of economic criteria in these examples, and in similar decision problems with many other natural resources, cannot be ignored. It should be clear that the physical facts of resource existence, and their capabilities to satisfy human wants, do not establish the criteria by which those natural resources are used; physical conditions can only set the limits within which correct answers are determined. In the utilization of any natural (or other) resource we cannot escape making choice as to whether or not to use a resource, the rate at which to use it, and the purpose of its use, causing these choices to be economic questions requiring economic criteria for their solution.

Part 2. Egyptian Natural Resources

Introduction : Egypt is an Arab, African, country The natural endearment to Egypt includes the geographical position, Nile, fertile lands, good climate conditions, and ancient monuments. The objective of this part is to shed the light on the natural resource availability and use.

a. Geographical position :

Egypt lies in the north eastern corner of Africa. Egypt is in the mid- way between north and south, east and west. Beside', this Unique position is a natural endowment to Egypt.

b. Physical Resources :

For the time being almost 96 % of the total physical land supply is desert. The government of Egypt is planning to increase the economic land supply to 25 % of the total physical supply to the year 2017. The government had started major land reclamation projects in El-Salhia, Qattara, Toshkey, Saini, .. etc. The objective is to increase agricultural production to meat the increase in food demand due to population increase, at 2.2 % annually, and income growth.

Mineral resources are either limited or yet unproven. However, the deserts supply the construction industry with gravel and fine sand suitable for concrete works; limestone is quarried near Alexandria, sandstone near Suez, alabaster near Assuit and Beni-Souef, granite and basalt near Aswan. Limestone, which is being increasingly used for fertilizer and cement, has become an important industrial

raw material Sinai supplied manganese, a minor export commodity. Phosphates, used as an input by the fertilizer industry for the production of superphosphates, are found near Kosseir in the Arabian desert, in the Dakhla oasis in the Libyan desert, and in Upper Egypt. Zinc, lead, chromium, tin, and gold exist in very small quantities, generally insufficient for economic exploitation. Nattron, a natural sodium carbonate, is a traditional input in the production of caustic soda, one of the earliest modern industries in Egypt.

At present, the most important mineral resources are iron ore and petroleum, and gas. Before the erection of an iron and steel complex in the 1960's, Egypt used to extract and export very small quantities of iron oxides (3,000 tons per year). Production of iron ore from mines located near Aswan generally considered as being of relatively poor quality reached 450,000 tons in 1970 and is entirely consumed by the domestic industry. Petroleum was discovered in Gemsa, sixty miles south of Suez, as early as 1908. Although one of the oldest in the Middle East, Egypt is still small producer as compared to other gulf producing countries. Until 1956, the Anglo-Egyptian Oilfields Company, largely owned by Shell with a minority holding by the Egyptian Government, was practically the sole exploiter. Output of crude oil doubled during the Second World War, from 670,000 to 1,344,000 tons (1939 and 1945), and increased to 2,250,000 tons in 1952. Now Egypt is producing almost 1 million barrel of all oil products per day. The early fields at Hurghada and Ras Gharib on the Red Sea were later

replaced by new discoveries in the same region and in Siani. Although exploration was undertaken in the Libyan desert, the Fayum, and other areas, the former regions remained the major producers until the late 1960s. The loss of Sinai in 1967 was fortunately more than compensated for by the development of a large oilfield at Al Morgan and by discoveries in the Western Desert, especially at Abu Gharadig (1970) and Al Razzaq (1972). The output of crude oil increased by 150 per cent between 1966 (8 million tons) and 1971 (20 million tons). Large-scale exploration is being undertaken at present by the Egyptian General Petroleum Corporation in co-operation with foreign – mainly U.S. and Italian and, recently, Japanese – firms.

Agriculture :

Despite the growing contribution of the desert, economic activity has been and may remain for a long time, concentrated in the Nile Valley and the Delta. The Valley is a long narrow ribbon, in places only 2 km and seldom more than 25 km wide; the Delta is an inverted triangle with a base 25 km wide; the Delta is an inverted triangle with a base of 260 km and a height of I60 km. A lateral branch of the Nile, converted and extended as a main canal (the Bahr Youssef) flows parallel to the River from Assiut to Fayum. The Fayum is a natural depression contiguous to the western edge of the Valley some 120 km south of Cairo. The Bahr contributed to the transformation of this small oasis into a rich agricultural province.

(a) Soils : This densely populated Egypt, with her five thousand villages and constellations of large towns, owes her existence to

the Nile The Nile literally created with its alluvial deposits the soils which enabled an old agrarian society to settle and survive throughout seventy or eighty long centuries. These soils are Egypt's main natural resource. They may be described as calcareous alluvium deposited at the rate of one metre per thousand year, rich in unweathered minerals because of the volcanic rocks of the Ethiopian highlands which form the silt. Thus they contain organic matter but not in sufficient quantities for the high nitrogen requirements of plants; potassium, however is in relatively good supply. The have a high clay content which makes them burdensome to cultivate, but with fertilizers, proper drainage, and correct doses of water they become among the most productive in the world. They owe to their common origin a great degree of homogeneity, the only difference being in the proportion of fine clay to coarser material which tends to increase from south to north and from the banks of the River to the edge of the Valley. The most usual soils are silty clay loam's and silty clays and because of this homogeneity crop allocation is not significantly constrained by the nature of the soils. Their origin explains the flat landscape of the Valley and the Delta and the sharp discontinuity between agricultural land and desert.

(b) Climate : The climate, though less uniform than the soil, is not extremely varied. There are only two main seasons summer and winter. The autumn and spring, short and undifferentiated, have little influence on plant growing patterns. The temperature hardly ever approaches freezing-point and plants are not subject to

damage from frost. the relatively warm winter climate permits cultivation throughout the year The growing period of most crops is relatively short. hence the wide scope for multicropping wherever water is available Vegetables grow in all seasons and fruit is gathered several months earlier than in Europe, hence opportunities for exports which Egypt has so far failed to seize Where the sea ceases to exert its moderating influence and the desert dominates, temperatures fall sharply at night. Differences of 15 °C. from day to night are uncommon in Upper Egypt, and plants benefit from the resulting abundant dew. Climatic differences affect crop patterns. The higher temperature in Upper Egypt favours sugar-cane, onions, and lentils, while the humid Delta has the ideal climate for long-staple cotton. Rainfall is scanty and irregular in the Northern Delta negligible elsewhere. Alexandria receive average of 120 mm. Upper Egypt from Assuit to Aswan is usually completely dry. Egypt owes both her water and her land to the Nile.

(c) Water and Irrigation : The almost exclusive dependence on a unique source of water supplies had significant implication for agriculture. Some political scientists would even argue that it influenced the nature of both State and society. The strong, centralized state is a feature explained by the infrastructure which requires control and regulation of a unique source of water supplies. Whether Egyptian history can be meaningfully interpreted with this model is a question left to specialists. What interests us here is that the development of agricultural has been

made possible by large public investment in irrigation undertaken in the nineteenth and the present centuries

The basin system which irrigated land by natural flooding has been gradually replaced by perennial irrigation. Water is distributed to the fields through a network of free-flowering, deep canals, and storage of floodwater in barrage reservoirs enables a redistribution from high to low season. The perennial system introduces flexibility since it regulates both the timing of irrigation and the quantities of water supplied to the land. It has enabled Egypt to take advantage of her warm climate and the fertility of her soils to expand multi-cropping. Further details on water supply is in the past.

Part 3. Structure of Egyptian Agricultural Sector

Three major activities constitutes the function of the sector They are

1. Plant production
2. Animal production
3. Fishing

For each activity, there are sub-sectors such as Horticulture, field crops, poultry, ... etc. Data in tables (3) - (4) clarify the relative importance for each sector and sub-sectors in terms of cultivated area and net income originated in each sub-sector.

Table (3) : Cropped and Cultivated Area in 1997.

Season	Area (Feddan)	% of the total
Total area for winter crops	6205924	44.87
Total area for summer crops	5951588	43.04
Total area for Nili crops	618718	4.47
Total area of Gardens	897821	7.14
Total area of Dates	64979	0.47
Total cropped area	13829030	
Crop Intensification Rate	1.83	100
Total land area	7556847	-

Source . Ministry of Agriculture and Land Reclamation, Agricultural Economic Statistics. 2nd part, issues June 1997 and August 1998

Table (4). Value of Agricultural Production and Net Income in Current Prices in 1996.

Item	Values 000' L.E.	% of the total
A. *Plant production*		
A.1. Total value of production	38046079	67.84
A.2. Value of inputs	4974512	8.87
A.3. Net income	33071567	58.97
B. *Animal production*		
B.1. Total value of production	15470468	27.59
B.2. Value of inputs	8863962	15.81
B.3. Net income	6606506	11.78
C. *Fish production*		
C.1. Total value of production	2564100	4.57
C.2. Value of inputs	352528	0.63
C.3. Net income	2211572	3.49
Total (A.1. + B.1. + C.1.)	56080647	100
Total (A.2. + B.2. + C.2.)	14191002	25.31
Total (A.3. + B.3. + C.3.)	41889645	74.69

Source : MALR, Agricultural Economic Statistics. Different Issues, 1997.

Accurate look at these statistics implies the dominance of plant production as major land and water user, and as income generator. Differences exist within the plant production between winter and summer crops, field crops and horticultural, ... etc. Yet the overall view emphasizes the dominance of this sector.

A.3. Current State of Agricultural Sector :

The total land supply in Egypt is almost 7.8 million feddan in 1999. About 5.9 million feddan of these lands are old land. And 1.9 million feddan are the reclaimed lands since 1952. The crop intensification rate is 1.83. Therefore, the total cropped area is about

13.83 million feddan. The land supply is still limited to about 4 % of the total physical land endowment which justifies the importance of maintaining the existing land supply and significance of vertical expansion. GOE plan for year 2017 is to extend the land supply to 25 % of the total area.

A.3.1. Technical Production Coefficients :

For each technical unit, there is limits for better utilizing the resources. For instance, resources, overall, are better utilized at intensification rate about 1.83 which means that the agricultural land is almost used twice a year. Data in table no. (3) support this result. At the small level, the technical production coefficient consider the exact technical level of resources needed to reach maximum output. This definition will help for better understanding of the production function latter on. Economist's views differ from Subject Matter Specialists (SMS's) at this point this because of the fact which states what is technically optimum is not necessarily to be economically optimum. Daniel Bromdey had tried to define a model which utilize the set of agricultural resources to be technically and economically optimum. Discussion in other parts of this course will clearify this point.

Technical and economic optimality determine the better utilization of the resources. It is vital to the agricultural policy makers to know how to allocate the resources to reach optimality. For instance if we consider one feddan of land which crop would be the best to cultivate to benefit both the farmer and society. Certain answers my exist. But the best answer is to look at the value added and to reallocate the resources according to maximum value added. For

instance in Egypt both rice and sugarcane utilize 35 % of the total water supply for agricultural use. At the same time both crops are cultivated in 12 % of cropped area and generate 13 % of the value added from agricultural. This surprising fact set a very big question mark on the agricultural decision. Detailed study to this point by the World Bank experts showed that the total requirement - water / land requirement (m^3/feddan) - for a feddan of sugarcane is 12,000 m^3 of water. The value added per m^3 is L.E. 0.01. The same values for sugar beat is 2700 m^3 of water per feddan and value added is L.E. 0.04. For some vegetable and fruit crops, the value added increases to limit of L.E. 0.08. But the calculations up to this level is still one sided. In policy evaluation, certain sets of variable should be considered to avoid the side effects. Sometimes the decision is based on cost / benefit and sometimes we consider the cost-effectiveness alternative.

A.3.2. Level of resource - Use :

As stated before, the total land supply is 7.8 million feddan cultivated almost two times a year to reach crop area about 13.83 million feddan. The first degree land supply is limited to 360 thousand feddans which represent about 6.1 % of the total land supply. Second and third land degree are about 84 % of the total land supply. The low quality land, forth degree, is about 10 % of the total land supply. These figures show the importance of improving the quality of land supply through effective maintenance programme.

Total water supply available for agricultural from all sources is 42.70 billion quibic meters. Almost 95 % of the agricultural water requirements is from Nile River - The Gift of God to Egypt - This amounts to 34 billion m^3 or 56 % Nile annual flow. Surface water

supply is 1.73 billion m^3 flows from about 9749 wells. This amount represents 3.22 % of the total water supply. The rest of water supply is from treated water and rains. These figures also emphasize the nature of irrigated agricultural. Professor Gamal Hemdan had defined the whole system which require a governorate and a system for resource use. Worthnoting is that 63 % of the total water supply is utilized by summer crops.

Total fixed investment allocated to agriculture is about 7.61 % of the total fixed investment. Total credit supply through principal Bank for Development and Agricultural Credit (BPDAC) is L.E. 2,43 billion in 1989/1990. The total foreign assistant to agriculture since 1981 is about USD 1.0 billion. A long with personal saving, this figures represent the total capital supply to agriculture. The supply is limited as compared to the objective of achieving 3 % - 4 % annual growth in agriculture.

Rural areas is initially labor suppliers this due to the fact that 50 % of the total population is in rural areas. The agricultural workers are the part of labor force which has regular work for about 1800 work hours / year. I do believe that the shortage is seasonal phonemen. But the needs also exist for good quality of training programmes and improvement of the quality of social environment.

Management is practiced in agriculture by farmers with support of cooperatives and extension systems. The rural women is now engaged in management of both the farm and rural house. As sated before for labor, also, the needs for good quality of training programme is vital to Egyptian agriculture and to Egypt. This part of labour force are the means of development. They also are the elements of national dominance since the population is increasing at rate 2.1 %

and food supply is limited to almost 2 % rate of growth. Agricultural development should have the first priority in our set of objectives. The situation now in year 2000 imputes certain emergency singes. The agricultural file is the hardest in all foreign trade agreements between Egypt and EC and even between EC and USA and other countries. Now in year 2000 we hear about banana war between European common market and USA, problems considering potato production in Egypt, bans on meat and chicken exports ... etc.

A.3.3. Economic and Technical Efficiency :

Sometimes, one can imagine that mixing the resources in production process is random or at the most purely technical. This wrong views set responsibility on economists. Define, the Production Possibility Fornteer (PPF) to show the maximum outputs (y_i & y_j) produced from a given resources, Figure (3).

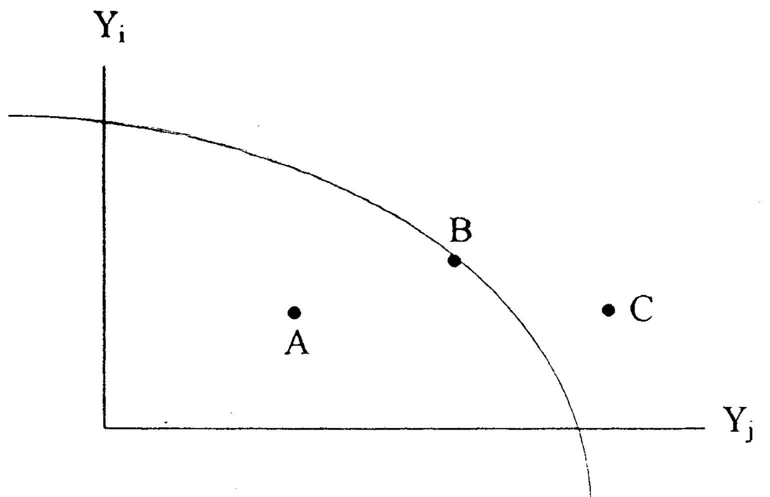

Figure (3) : Production Possibility Fornteer (PPF)

Technicians may recommend producing at (A) or (C) but economist always recommend production at B. This sense implies objection to over (under) - use. The resources, is then, should be allocated in the way that grantee economic efficiency. The

government fund and facilitate investment to motivate development through vertical and horizontal agricultural policy programmes The set of resource supply may grantee technical efficiency But to increase production from the same level of resource - use this what we mean by economic efficiency. Figure (4). In other words, the resource base produces more output.

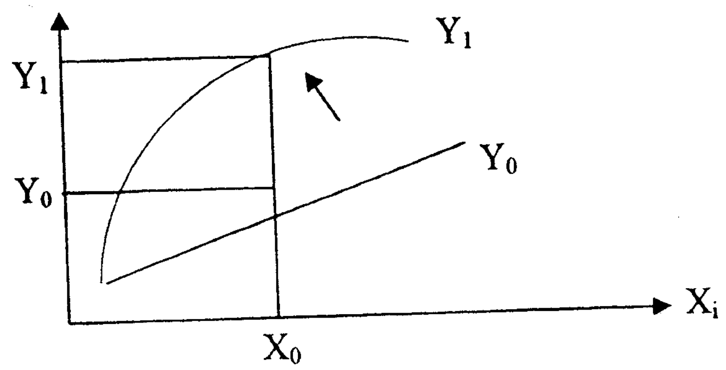

Figure (4). Efficiency from Resource Base.

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